CLAIMS:

We claim the following:

Sub B1

1. A method for reducing the temperature in a vertical-cavity surface-emitting laser (VCSEL) , the method comprising:

forming at least one of a heat spreading layers adjacent at least one of a reflecting surfaces in a VCSEL;

said at least one of the heat spreading layers reducing the VCSEL temperature by allowing heat to bypass said one of the reflecting surfaces.

2. The method according to claim 1, wherein at least one of the heat spreading layers is doped with an n-type material.

3. The method according to claim 2, wherein the n-type material includes an InP compound.

4. The method according to claim 1, wherein at least one of the reflecting surfaces is a Distributed Bragg Reflector (DBR).

Sub B2

5. The method according to claim 1, further comprising the step of forming a tunnel junction between an apertured active region and the at least one of the reflecting surfaces.

Sub B3

6. The method according to claim 5, wherein the active region comprises an alloy of InAlGaAs approximately lattice matched to InP.

7. The method according to claim 5, wherein the active region comprises an alloy of InGaAsP approximately lattice matched to InP.

8. The method according to claim 5, wherein the active region comprises an alloy of InGaAs approximately lattice matched to InP.

9. The method according to claim 4, wherein the DBR is made of alternating layers of $Al_{a1}Ga_{1-a1}As_bSb_{1-b}$ and $Al_{a2}Ga_{1-a2}As_bSb_{1-b}$.

10. The method according to claim 9, wherein b is greater than about 0.5, a1 is greater than about 0.9, and a2 is less than about 0.3.

A2

11. The method according to claim 4, wherein the DBR is undoped.

12. The method according to claim 1, wherein the VCSEL exhibits continuous wave operation at temperatures greater than about 80 degrees Celsius.

13. The method according to claim 5, wherein the tunnel junction comprises of n-type InP and p-type InAlAs.

14. The method according to claim 1, wherein the heat spreading layer has a thickness of about 1-3λ.

15. The method according to claim 5, wherein a mixture selectively etches the active region to form an aperture in the VCSEL, said mixture precluding substantial etching of the heat spreading layer.

16. A method for reducing the thermal impedance in a vertical-cavity surface-emitting laser (VCSEL) , the method comprising:

forming a first heat spreading layer between a first reflecting surface and an active region in a VCSEL;

providing a second heat spreading layer between a second reflecting surface and the active region in a VCSEL; and

said first and second heat spreading layers reduce the thermal impedance in the VCSEL by allowing an injected current to bypass the reflecting surfaces.

17. The method according to claim 16, wherein the first and the second heat spreading layers are doped with an n-type material.

18. The method according to claim 17, wherein the n-type material includes an InP compound.

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19. The method according to claim 16, wherein the first and the second reflecting surfaces are Distributed Bragg Reflectors (DBRs).

Sub B7

20. The method according to claim 16, further comprising the step of forming a tunnel junction between an apertured active region and the first reflecting surface.

Sub A3

21. The method according to claim 20, wherein the active region comprises of an alloy of InAlGaAs approximately lattice matched to InP.

22. The method according to claim 20, wherein the active region comprises an alloy of InGaAsP approximately lattice matched to InP.

23. The method according to claim 20, wherein the active region comprises an alloy of InGaAs approximately lattice matched to InP.

24. The method according to claim 17, wherein the DBR is made of alternating layers of $Al_{a1}Ga_{1-a1}As_{b}Sb_{1-b}$ and $Al_{a2}Ga_{1-a2}As_{b}Sb_{1-b}$.

25. The method according to claim 20, wherein b is greater than about 0.5, a1 is greater than about 0.9, and a2 is less than about 0.3.

26. The method according to claim 19, wherein the DBRs are undoped.

23. The method according to claim 16, wherein the VCSEL exhibits continuous wave operation at temperatures greater than about 80 degrees Celsius.

27. The method according to claim 20, wherein the tunnel junction comprises of n-type InP and p-type InAlAs.

28. The method according to claim 16, wherein the heat spreading layers have a thickness of about 1-3λ.

29. The method according to claim 20, wherein a mixture selectively etches the active region to form an aperture in the VCSEL, said mixture precluding substantial etching of the heat spreading layer.

A3

30. A vertical-cavity surface-emitting laser (VCSEL) operating at a reduced temperature, the VCSEL comprising:

a first and a second reflecting surface in a VCSEL;

at least one active region in the VCSEL;

a first and a second heat spreading layer in the VCSEL; and

the first and second heat spreading layers allowing heat generated in the VCSEL to bypass the first and second reflecting surfaces, thereby reducing the temperature of the VCSEL.

31. The vertical-cavity surface-emitting laser (VCSEL) according to claim 30, wherein the first and second heat spreading layers are chosen such that optical reflections from their edges add in phase with reflections from the first and second reflecting surface.